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(Translation)

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Title of the Invention: WATER-BASED PAINT MIST TREATMENT AGENT
Application Number: 4-286838
Filing Date: September 30, 1992
Inventor: Makoto TANAKA
Applicant: NEOS CO., Ltd.

[Claims]

[Claim 1]

A water-based paint mist treatment agent containing one or more cationic polymers selected from the group consisting of cationic cellulose, polyglucosamine, and cationic polyvinyl alcohol.

[Claim 2]

A water-based paint mist treatment agent characterized by containing a cationic polymer of claim 1 and a nitrogen-containing vinyl-based polymeric flocculating agent.

[Claim 3]

A water-based paint mist treatment agent characterized by containing a cationic polymer of claim 1, a nitrogen-containing vinyl-based polymeric flocculating agent of claim 2, and an inorganic coagulant.

[Detailed Description of the Invention]

[0001]

[Industrial Applicability]

The present invention relates to a water-based paint mist treatment agent for flocculating surplus paint mists, particularly surplus water-based paint mists discharged into

circulating water in a wet paint booth, so as to separate the mists from water, and reducing the adhesiveness of the paint mists so as to prevent the surplus paint mists from adhering to the inside of a circulation system of the wet paint booth, thereby facilitating easy collection of the paint mists.

[0002]

[Prior Art]

Conventionally, a wet paint booth in which surplus paint mists are collected by circulating water has been used for painting vehicles, electronic products, furniture, etc. In recent years, the use of water-based paint is increasing in consideration of environmental conservation. Oil-based paint for general use is hydrophobic, and thus particles thereof aggregate together into a great flocculent mass when put in water. As a result, the particles adhere to a circulation system of the paint booth (e.g., a water screen plate, a shower nozzle, a pipe strainer, a pump, or the like), and thus cause various malfunctions while incurring the risk of a fire. Further, there is a disadvantage in that the painting environment is deteriorated. On the other hand, water-based paint uses water as its medium. Accordingly, the water-based paint hardly adheres to the circulation system of the paint booth and is nonflammable, thereby having an advantage of improving the painting environment. However, water-based paint mixed with circulating water accumulates, with particles thereof being dispersed in the water, and therefore solid portions are increased, resulting in an increase of adhesiveness of the circulating water, a reduction in amount of water which can be circulated, thereby causing a reduction of discharge efficiency. Moreover, there are problems in that the foaming property of the circulating water is increased and decomposition occurs due to an increase in COD.

[0003]

Examples of conventional methods for solving such problems include a method, which uses an inorganic flocculating agent, such as aluminum sulfate or polyaluminum chloride, and a high-molecular-weight polymer (disclosed in Japanese Laid-Open Patent Publication No. 52-71538), and a method, which uses a cationic polymer and an anionic polymer (disclosed in Japanese Laid-Open Patent Publication No. 63-42706). However, even if treatment is performed according to such a method, it is difficult to rapidly perform flocculation and separation. Circulating water loses its clarity and is easily decomposed. Moreover, adhesiveness of paint cannot be sufficiently reduced, thereby causing problems during the step of separating paint sediment, e.g., the bottom of a thickener is clogged and a filter cloth of a centrifuge is clogged.

[0004]

[Problems to be Solved by the Invention]

In view of the above-described problems, the present invention is made to provide a water-based paint mist treatment agent which is effective in flocculation and separation for draining water-based paint and sufficiently reduces the adhesiveness of the paint so that flocculation and separation operations can be performed smoothly during a separation step and the flocculation and separation properties of the treatment agent are not deteriorated even if water containing the treatment agent is reused for flocculation and separation.

[0005]

[Means for Solving the Problems]

The present invention is made based on the knowledge that a specific cationic polymer is effective in solving the above-described problems. Specifically, the present invention provides a water-based paint mist treatment agent

containing one or more cationic polymers selected from the group consisting of cationic cellulose, polyglucosamine, and cationic polyvinyl alcohol.

[0006]

Cationic cellulose for use in the present invention can be synthesized by adding a cationic monomer to a variety of types of cellulose. Examples of cellulose include methylcellulose, hydroxyethylcellulose, and hydroxypropylcellulose.

[0007]

Examples of the cationic monomer include dialkylaminoethylmethacrylate, dialkylaminoethylacrylate, trialkylammoniumethylmethacrylate chloride, trialkylammoniumethylacrylate chloride, vinylamine, allylamine, diallylamine, dialkyldiallylammonium chloride, dialkylaminopropylacrylamide, and trialkylammoniumpropylacrylamide chloride. One example of commercial cationic cellulose is "Leoguard" [spelled phonetically according to Japanese pronunciation] manufactured by Lion Corp.

[0008]

Polyglucosamine is also referred to as chitosan and is used in the form of a salt such as hydrochloride or acetate.

[0009]

Cationic polyvinyl alcohol can be obtained by adding a cationic monomer to polyvinyl alcohol. Degrees of saponification and polymerization of polyvinyl alcohol are preferably 60% or more and 500-3000, respectively. The cationic monomer is the same as that used for cationic denaturation of the above-described cellulose. One example of commercial cationic polyvinyl alcohol is "Gohsefimer" [spelled phonetically according to Japanese pronunciation]

manufactured by The Nippon Synthetic Chemical Industry Co., Ltd.

[0010]

It is possible to further improve the flocculating property of the water-based paint mist treatment agent by using a nitrogen-containing vinyl-based polymeric flocculating agent together with the above-described cationic polymer. The nitrogen-containing vinyl-based polymeric flocculation agent is polyacrylamide, polymethacrylamide, or a polymer of the cationic monomers described above in conjunction with the cationic cellulose. Alternatively, a copolymer of acrylamide, methacrylamide, and the above-described cationic monomer can be used. Particularly, polyacrylamide, polymethacrylamide, polydialkylaminoethylacrylate, polydialkylaminoethylmethacrylate, or a copolymer thereof is preferable. The mixture ratio of the cationic polymer to the nitrogen-containing vinyl-based polymeric flocculating agent is preferably from 1 : 50 to 50 : 1 by weight.

[0011]

Moreover, it is possible to further improve the flocculating and separating properties and nonadhesiveness of paint sediment by additionally using an inorganic coagulant together with the mixture of a cationic polymer and a nitrogen-containing vinyl-based polymeric flocculating agent. Examples of the inorganic coagulant include aluminum sulfate, aluminum chloride, ammonium alum, potassium alum, ferric sulfate, ferric chloride, zinc chloride, zinc sulfate, polyaluminum chloride, polyaluminum sulfate, polyferric sulfate, and polyferric chloride. Among these, polyaluminum chloride and polyferric sulfate are preferable, since they are more effective than aluminum chloride and ferric sulfate even when used in small amounts. The mixture ratio of the cationic polymer to the nitrogen-containing vinyl-based

polymeric flocculating agent included in an inorganic coagulant is preferably from 10 : 1 to 1 : 100 by weight.

[0012]

A water-based paint mist treatment agent of the present invention can be obtained by basically dissolving the above-described components so as to be 0.1-40 wt.% in water. Alternatively, another additive, for example, an antiseptic agent, a defoaming agent, or a rust-preventive agent, can be suitably mixed therewith, if desired. The amount of the water-based paint mist treatment agent to be used depends on the type of water-based paint to be treated. Generally, the water-based paint mist treatment agent is 5-100 wt.% to solid portions of mixed paint.

[0013]

In general, water-based paint is anionic and an aqueous solution thereof is alkaline. Accordingly, a cationic flocculating agent is effective. An inorganic coagulant has a high coagulation value and is highly coagulative. However, the inorganic coagulant has disadvantages in that the required dosage thereof is high, coagulated sludge is bulky, and the amount of water contained is great. On the other hand, the organic polymeric flocculating agent has advantages in that the required dosage thereof is low, coagulated sludge is not bulky, and the amount of water contained is small. However, in the case of the water-based paint, the amount of paint mixed with circulating water is great, and thus it is not possible to sufficiently neutralize electric charge for flocculation only by normal addition of an organic polymeric flocculating agent. Accordingly, it often happens that an inorganic coagulant is used as a main ingredient together with an organic polymeric flocculating agent. However, by using a specific cationic polymer described herein alone or together with a nitrogen-containing vinyl-based polymeric flocculating agent and/or

an inorganic coagulant, it is possible to improve the flocculating and separating properties and nonadhesiveness of a water-based paint mist treatment agent.

[0014]

{Examples}

Hereinafter, examples of the present invention will be described.

[0015]

Example 1

A water-based paint mist treatment agent was prepared by dissolving 1 part by weight of methylcellulose (METOLOSE SM25 manufactured by SHINETSU CHEMICAL CO., LTD.) and 5 parts by weight of dimethylaminoethylmethacrylate in 91.5 parts by weight of water, adding to the resultant solution 2.5 parts by weight of 0.1 M solution obtained by dissolving cerium ammonium in 1 N sulfuric acid, and adding 95 parts by weight of water to 5 parts by weight of solid cationic cellulose obtained after three hours of reaction at 20°C.

[0016]

Example 2

2 parts by weight of methylcellulose (METOLOSE SM25), and 5 parts by weight of trimethylanmmoniumethylethacrylate chloride were dissolved in 91.5 parts by weight of water, 0.01 parts by weight of potassium persulfate and 0.01 parts by weight of sodium sulfite were added to the resultant solution, and the reaction was stopped by adding 0.005 parts by weight of hydroquinone to the resultant solution when the viscosity thereof reached 100 cp after 3-4 hours of reaction at 30°C, thereby preparing a water-based paint mist treatment agent.

[0017]

Example 3

A water-based paint mist treatment agent was prepared by dissolving 2 parts by weight of cationic cellulose (Leoguard MGP manufactured by LION CORP.) in 98 parts by weight of water.

[0018]

Example 4

A water-based paint mist treatment agent was prepared by dissolving 1 part by weight of polyglucosamine (Flonac N manufactured by KYOWA YUSHI KOGYO CO.) and 0.5 parts by weight of 35% hydrochloric acid in 98.5 parts by weight of water.

[0019]

Example 5

A water-based paint mist treatment agent was prepared by dissolving 2 parts by weight of polyvinyl alcohol (POVAL PA-24 manufactured by SHINETSU CHEMICAL CO., LTD.) in 30 parts by weight of 20% sulfuric acid, thereafter adding 15 parts by weight of epichlorohydrin to the resultant solution, adding 20 parts by weight of diethylenetriamine to the resultant solution after two hours of reaction at 30°C, and adding 95 parts by weight of water to 5 parts by weight of solid cationic polyvinyl alcohol obtained after three hours of reaction at 60°C.

[0020]

Example 6

A water-based paint mist treatment agent was prepared by dissolving 1 part by weight of polyvinyl alcohol (POVAL PA-24) and 5 parts by weight of dimethyl-aminoethylmethacrylate in 91.5 parts by weight of water, adding to the resultant solution 2.5 parts by weight of 0.1 M solution obtained by dissolving cerium ammonium in 1 N

sulfuric acid, and adding 95 parts by weight of water to 5 parts by weight of solid cationic cellulose obtained after three hours of reaction at 20°C.

[0021]

Example 7

1 part by weight of polyvinyl alcohol (POVAL PA-24) and 6 parts by weight of triethylammoniumethylmethacrylate chloride were dissolved in 91.5 parts by weight of water, 0.01 parts by weight of benzoyl peroxide was added to the resultant solution, and 3-4 hours of reaction was performed after the resultant solution was heated to 65°C. The reaction was stopped by adding 0.001 part by weight of hydroquinone to the resultant solution when the viscosity thereof reached 100 cp, thereby preparing a water-based paint mist treatment agent.

[0022]

Example 8

A water-based paint mist treatment agent was prepared by dissolving 1 part by weight of the cationic cellulose synthesized in Example 1 and 0.1 parts by weight of commercial polyacrylamide (SANFLOC N-505P manufactured by SANYO CHEMICAL INDUSTRIES, LTD.) in 98.9 parts by weight of water.

[0023]

Example 9

A water-based paint mist treatment agent was prepared by dissolving 0.2 parts by weight of the cationic cellulose synthesized in Example 1 and 2 parts by weight of polymethylammoniumethylmethacrylate chloride (SHAROL [spelled phonetically according to Japanese pronunciation] DM663P manufactured by DAIICHI INDUSTRIAL CO., LTD.) in 97.8 parts by weight of water.

[0024]

Example 10

A water-based paint mist treatment agent was prepared by adding 0.1 parts by weight of polyacrylamide (SANFLOC N-505P) to 99.9 parts by weight of the water-based paint mist treatment agent prepared in Example 4.

[0025]

Example 11

A water-based paint mist treatment agent was prepared by dissolving 1 part by weight of the cationic polyvinyl alcohol synthesized in Example 5 and 0.1 parts by weight of commercial polyacrylamide (SANFLOC N-505P) in 98.9 parts by weight of water.

[0026]

Example 12

A water-based paint mist treatment agent was prepared by dissolving 3 parts by weight of the cationic polyvinyl alcohol synthesized in Example 6 and 0.1 parts by weight of commercial cationic polyacrylamide (SANFLOC C-609P manufactured by SANYO CHEMICAL INDUSTRIES, LTD.) in 96.9 parts by weight of water.

[0027]

Example 13

A water-based paint mist treatment agent was prepared by dissolving 2 parts by weight of cationic polyvinyl alcohol (Gohsefimer K-210 manufactured by The Nippon Synthetic Chemical Industry Co., Ltd.) and 0.1 parts by weight of SANFLOC C-609P in 97.9 parts by weight of water.

[0028]

Example 14

A water-based paint mist treatment agent was prepared by dissolving 1 part by weight of the cationic cellulose

synthesized in Example 1, 0.1 parts by weight of SANFLOC N-505P, and 15 parts by weight of polyaluminum chloride in 83.9 parts by weight of water.

[0029]

Example 15

A water-based paint mist treatment agent was prepared by dissolving 1 part by weight of the cationic cellulose synthesized in Example 2, 0.1 parts by weight of SANFLOC C-609P, and 15 parts by weight of polyaluminum chloride in 83.9 parts by weight of water.

[0030]

Example 16

A water-based paint mist treatment agent was prepared by dissolving 1 part by weight of Leoguard MGP, 1 part by weight of SHAROL DM663P, and 40 parts by weight of a poly ferric sulfate solution in 58 parts by weight of water.

[0031]

Example 17

A water-based paint mist treatment agent was prepared by adding 0.1 parts by weight of SANFLOC N-505P and 15 parts by weight of polyaluminum chloride to 84.9 parts by weight of the water-based paint mist treatment agent prepared in Example 4.

[0032]

Example 18

A water-based paint mist treatment agent was prepared by adding 0.1 parts by weight of SANFLOC N-505P and 15 parts by weight of polyaluminum chloride to 1 part by weight of the cationic polyvinyl alcohol synthesized in Example 5.

[0033]

Example 19

A water-based paint mist treatment agent was prepared by adding 0.1 parts by weight of SANFLOC C-609P and 15 parts by weight of polyaluminum chloride to 1 part by weight of the cationic polyvinyl alcohol synthesized in Example 6.

[0034]

Example 20

A water-based paint mist treatment agent was prepared by dissolving 0.2 parts by weight of Gohsefimer K-210, 2 parts by weight of SHAROL DM663P, and 40 parts by weight of a poly ferric sulfate solution in 57.8 parts by weight of water.

[0035]

Comparative Example 1

A water-based paint mist treatment agent was prepared by dissolving 30 parts by weight of polyaluminum chloride in 70 parts by weight of water.

[0036]

Comparative Example 2

A water-based paint mist treatment agent was prepared by dissolving 3.2 parts by weight of 30 wt.% polyaluminum chloride aqueous solution in 96.8 parts by weight of 0.1 wt.% SANFLOC C-609P aqueous solution.

[0037]

Comparative Example 3

A binary system water-based paint mist treatment agent was prepared by dissolving 3.2 parts by weight of 30 wt.% poly ferric sulfate aqueous solution in 96.8 parts by weight of 0.1 wt.% SANFLOC N-505P aqueous solution. The water-based paint mist treatment agents prepared in the above-described examples and comparative examples were evaluated according to the following methods. The evaluation results are shown in Table 1

[0038]

(1) Evaluation of flocculation and separation of paint sediment

A water test sample containing 5000 ppm of solids was prepared by adding water-based paint (water-based acrylic intermediate paint for automobiles having 40 wt.% of solids) to mains water. 400 ml of the test sample was poured into a 500 ml beaker, a prescribed concentration of a water-based paint mist treatment agent was added thereto, and thereafter the resultant solution was stirred at 150 rpm for 2 minutes using a jar tester. The resultant solution was further stirred at 50 rpm for 5 minutes and was kept standing before the clarity of the sample was measured by transparency (JIS K 0102). The volume of precipitating paint sediment was measured.

[0039]

(2) Evaluation of adhesiveness of paint sediment

The precipitating paint sediment was separated using a glass filter and was spread over a stainless steel plate so as to be 3 mm in thickness and 40 mm in diameter. A measurement plate having a 30 mm diameter was placed thereon and pulled up at a stretch after applying 500 g load on the measurement plate for 5 seconds. Adhesiveness was measured as tensile load at the time the measurement plate was removed from the paint sediment using a tensile and compressive load measurement device (IMADA SEISAKUSHO).

[0040]

(3) Overall evaluation

Overall evaluation was conducted in the following manner.

◎: Water-based paint has particularly good flocculating and separating properties and adhesiveness of paint sediment is particularly low.

○: Water-based paint has good flocculating and separating properties and adhesiveness of paint sediment is low.

△: Water-based paint has slightly poor flocculating and separating properties and paint sediment is adhesive.

[0041]

[Table 1]

		Concentration of solid portions in treatment agent (ppm)	Transparency (cm)	Volume of paint sediment (cm^3)	Adhesiveness ($\times 10^3$Pa)	Evaluation
Example	1	50	31	48	3.3	○
	2	50	29	52	4.1	○
	3	50	32	40	3.1	○
	4	50	33	44	3.1	○
	5	50	34	44	3.3	○
	6	50	31	40	3.2	○
	7	50	33	40	3.4	○
	8	40	44	28	2.2	○
	9	40	45	32	2.4	○
	10	40	43	36	2.7	○
	11	40	47	32	2.5	○
	12	40	43	28	2.6	○
	13	40	42	28	2.8	○
	14	300	50 or more	52	1.4	◎
	15	300	50 or more	48	1.7	◎
	16	300	50 or more	60	1.8	◎
	17	300	50 or more	56	1.2	◎
	18	300	50 or more	52	1.2	◎
	19	300	50 or more	48	1.6	◎
	20	300	50 or more	40	1.8	◎
Comparative Example	1	500	23	100	5.9	△
	2	400	22	96	4.5	△
	3	400	20	90	4.7	△

[0042]

[Effects of the Invention]

By using an aqueous treatment agent according to the present invention, flocculation and separation of paint sediment dispersed in water is facilitated, so that the paint sediment becomes less bulky and adhesiveness of the paint sediment is reduced. Accordingly, flocculating and separating operations can be smoothly performed, whereby it is possible to sequentially perform drainage treatment.

[Abstract]

[Objective]

The present invention relates to a water-based paint mist treatment agent for flocculating surplus paint mists, particularly surplus water-based paint mists discharged into circulating water in a wet paint booth, so as to separate the mists from water, and reducing the adhesiveness of the paint mists so as to prevent the surplus paint mists from adhering to the inside of a circulation system of the wet paint booth, thereby facilitating easy collection of the paint mists.

[Structure]

A water-based paint mist treatment agent contains one or more cationic polymers selected from the group consisting of cationic cellulose, polyglucosamine, and cationic polyvinyl alcohol. Another water-based paint mist treatment agent contains a nitrogen-containing vinyl-based polymeric flocculating agent and an inorganic coagulant.